



Abrasion-Resistant Polymer Composite Overlays and Coatings

Problem

For over sixty years, vinyl coating systems have been the primary system of choice to protect steel gates on navigation structures from corrosion. A twenty-plus year life expectancy is common before maintenance painting is required. However, locations with high abrasion from debris- and silt-filled flowing water have had normally tough vinyl coatings become significantly damaged in less than five years. The abrasive conditions are the most prevalent on the downstream side of a tainter gate. Polymer composite overlays and coatings provide the possibility of increased service life.



Vinyl coating in poor condition due to abrasive action of debris-filled swirling water

Approach

This research effort focuses on the use of abrasion-resistant polymer composite overlays and coatings to protect the downstream side of tainter gates where swirling debris rapidly deteriorates a conventional vinyl coating system. To evaluate the performance of abrasion-resistant coatings, five different types of polymer composite coatings and an adhesively applied ultra-high molecular weight polyethylene (UHMWPE) thin plate were evaluated in the laboratory. The performance of these new materials was compared to standard Corps of Engineers vinyl coating systems 3-A-Z and 5-E-Z. (3-A-Z is a vinyl zinc-rich primer with an aluminum vinyl topcoat system and 5-E-Z is a vinyl zinc-rich primer with a gray vinyl topcoat system.) Based on laboratory results, two different ceramic-filled composite coatings and the adhesively applied UHMWPE thin plate were selected for a field installation on a tainter gate where rapid abrasion is a known problem. A demonstration test of these systems is planned at Heflin Dam, near Gainesville, Alabama, during the Spring of 2014. The ceramic-filled composite coatings will be applied directly over bare steel as well as over a standard vinyl system.



Laboratory abrasion testing of candidate systems using a reciprocating abrader.

Products

The primary product of this work will be engineer guidance on the use and installation of abrasion-resistant polymer composite overlays and coatings to protect the downstream side of tainter gates where the abrasive action of turbulent, debris-filled water prematurely degrades a conventional vinyl coating system. Initially this guidance will be made available as a Tech Note. If the performance is verified by the field installation, the ceramic-filled composites coatings will be submitted for future updates of UFGS-09 97 02, Painting: Hydraulic Structures. The overall investigation and field demonstration will also be described in a series of technical transfer products, including conference proceedings, technical reports, articles in publications such as Navigation e-News, and webinars.

Benefits

The abrasion-resistant coatings and overlays will reduce maintenance and out-of-service costs where premature failures of standard vinyl coating systems occur in highly abrasive service conditions. Further cost benefits are possible since the abrasion-resistant coatings and overlays can be applied just to areas of high abrasion, with a standard vinyl coating system protecting areas of low abrasion.

POC: Richard Lampo
Charles E. "Eddie" Wiggins

Richard.G.Lampo@usace.army.mil
Charles.E.Wiggins@usace.army.mil